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GEOLOGY.—*The age of the supposed Lower Cretaceous of Alabama.* EDWARD W. BERRY, The Johns Hopkins University.[1]

A considerable area in eastern Alabama, extending from about the latitude of Montgomery eastward into Georgia was mapped in the 80's and 90's of the last century by the Alabama and Georgia geologists as a part of the Tuscaloosa formation of western central Alabama.[2] Stratigraphically the beds in question, which are predominately sands and clays, lie upon the crystallines, and are unconformably overlain by the sediments of the Eutaw formation.

The physical evidence, admittedly inconclusive, led Clark, Stephenson, and the writer, to tentatively regard them as the continuation of the "Hamburg beds" of South Carolina, the "Cape Fear" formation of North Carolina, and the Patuxent formation of Maryland and Virginia. This opinion seemed to be partially confirmed by the discovery (in 1910 by L. W. Stephenson) of poorly preserved plant fossils in a bluff on the Tallapoosa River, near Old Fort Decatur in Macon County, Alabama. These fossils were submitted to the writer, who, although unable to conclusively determine any of the forms, was led by the presence of certain cycadophyte remains, to express the opinion that the deposit was of Lower Cretaceous age. The presence of numbers of dicotyledonous leaves led to the suggestion that these beds were younger than the Patuxent formation and could scarcely be older than the Patapsco formation of the Maryland-Virginia region.

This opinion was quoted in whole or in part by Clark in 1911[3] and by Stephenson in 1912 and 1914.[4] The writer visited Old Fort

[1] Published by permission of the Director of the U. S. Geological Survey.

[2] LANGDON, D. W., Geol. Soc. Amer. Bull. 2: 587–606. 1890; VEATCH, OTTO, Geol. Survey Georgia Bull., no. 18: 82–106. 1909.

[3] CLARK, W. B., Maryland Geol. Survey Lower Cretaceous pp. 96, 97. 1911.

[4] STEPHENSON, L. W., U. S. Geol. Survey prof. paper 71: 606. 1912; *idem.* 81: 11. 1914.

Decatur in the summer of 1911 without, however, any success in obtaining identifiable fossils. No additional attempt at settling the question was made until the summer of 1923 when Stephenson revisited the locality, and collected a small amount of poor material which was submitted to the writer. Although, as just stated, this material was as badly macerated and poorly preserved as previous collections, it contained one form that appears to be certainly identifiable, and several others that it was found possible to name tentatively. These indicate that the deposit is Upper and not Lower Cretaceous in age, thus confirming the earlier opinion of the Alabama Geological Survey. This conclusion seems important enough to warrant the present note and to justify the appearance in print of the evidence upon which it is based.

The species positively determined represents Araucarian cone-scales, first discovered in west Greenland, and named *Dammara borealis* by Heer.[5] The Alabama specimens are shown in the accompanying figures 5 and 6. This species has been recorded from a large number of localities in both North America and Europe, but since the various known species of Dammara have very similar cone-scales too much reliance can not be placed upon specific determination. All of the known fossil species of Dammara are, however, Upper Cretaceous in age. In this country *Dammara borealis* has been recorded from the Raritan, Tuscaloosa, Magothy and Black Creek formations, and since all of these occurrences except the first were identified by the present writer, and thus may be presumed to represent the same species of Dammara, their occurrence at Old Fort Decatur points to an age certainly not older and possibly considerably younger than the Cenomanian stage of the European Upper Cretaceous.

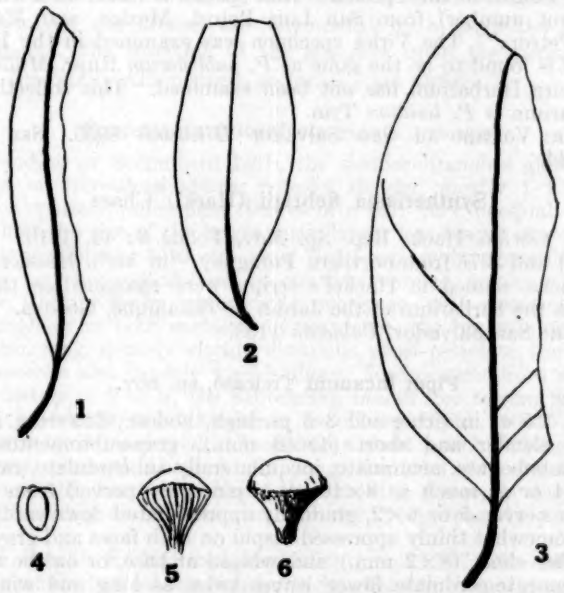
TABLE I

	TUSCALOOSA FORM	RARITAN FORM	DAKOTA SS.	MAGOTHY FORM	BLACK CREEK FORM	ATANE BEDS	PATOOT BEDS	WOODBINE SAND	BINGEN SAND	EUTAW FORM
Cycadinocarpus circularis	X	X			?					
Dammara borealis	X	X		X		X				
Diospyros primaeva	X	X	X	X	X	X	X	X		
Inga cretacea	X		X							
Salix flexuosa	X	X	X	X	X				X	X

[5] HEER, O., Fl. Foss. Arct., 6: Abt. 2: 54, *pl. 37, fig. 5.* 1882.

As can be seen from the accompanying figures, the balance of the material is very incomplete. The tentative determinations which it has been possible to make are given in the explanation of these figures. The ranges of the species with which the Alabama specimens have been compared may be given briefly in tabular form as follows:

The wide range, and the uncertainty of identification of these forms in the present collection, rob them of any certainty for purposes of precise correlation, but as none of them suggests any late Lower Cretaceous species known to the writer they are entitled to some weight, and as all of them have been found in the known Tuscaloosa formation of Alabama, and as one of the species seems to be positively identified, it would seem that the plant-bearing beds at Old Fort Decatur are of about the age of the Tuscaloosa formation of western central Alabama.



Explanation of Figs. 1–6

1. *Salix flexuosa* Newberry (?). 2. *Inga cf. cretacea* Lesquereux. 3. *Diospyros primaeva* Heer (?). 4. *Cycadinocarpus circularis* Newberry (?). 5, 6. *Dammara borealis* Heer.

BOTANY.—*New species of plants from Salvador. II.*[1] PAUL C. STANDLEY, U. S. National Museum.

In the present paper the notes upon two species of grasses have been furnished by Mrs. Agnes Chase, of the U. S. Department of Agriculture, and the description of a new species of *Piper* by Dr. William Trelease of the University of Illinois.

Paspalum botteri (Fourn.) Chase

Dimorphostachys botteri Fourn. Mex. Pl. **2**: 14. 1886. Based on *Botteri* 118, collected at Orizaba, Mexico. The specimen was examined in the Paris Herbarium. This is the species described as *Paspalum macrophyllum* H. B. K. by Nash.[2] The type of that species, also in the Paris Herbarium, was likewise examined, and is found to belong to a different group, not to that of *P. botteri* and its allies (the genus *Dimorphostachys* of Fournier) in which the first glume is developed in at least one of each pair of spikelets. Chase in Hitchcock's Mexican Grasses[3] misapplied the name *Paspalum planifolium* Fourn. to this species. That species is based on a Virlet specimen (without number) from San Luis Potosí, Mexico, and *Müller* 2062 "in herb. Petrop." The Virlet specimen was examined in the Paris Herbarium and is found to be the same as *P. publiflorum* Rupr. *Müller* 2062 in St. Petersburg Herbarium has not been examined. This collection in the Kew Herbarium is *P. lividum* Trin.

SALVADOR: Volcano of San Salvador *Hitchcock* 8956. San Salvador *Calderón* 944.

Syntherisma fiebrigii (Hack.) Chase

Panicum fiebrigii Hack. Rep. Sp. Nov. Fedde **8**: 46. 1910. Based on *Fiebrig* 5371 and 5375 from northern Paraguay, "in herb. Hassler." These two specimens, named in Hackel's script, were examined in the Hassler collection in the herbarium of the Jardin de Botanique, Geneva.

SALVADOR: San Salvador, *Calderón* 1153.

Piper incanum Trelease, sp. nov.

A shrub, 1.5 or in richer soil 3–5 m. high, nodose; flowering internodes moderately slender and short (4×40 mm.), gray-subtomentose; leaves elliptic or subobovate, acuminate, inequilaterally subcordulate, rather small (5–6×12–14 or as much as 8×16 cm.), pinnately nerved from below the middle, the nerves 5 or 6×2, gradually approximated downward, at length bullulate, somewhat thinly appressed-hispid on both faces and gray beneath; petiole rather short (8×2 mm.) and winged at base, or on the more equilaterally truncate-cordulate lower leaves twice as long and winged to or beyond the middle; spikes opposite the leaves, gray-mucronate, in fruit 3×80 mm.; bracts roundish-subpeltate, gray-ciliate; peduncle gray-hairy, 12 mm. long; berries obconic, glabrous; stigmas 3, sessile.

[1] Published by permission of the Secretary of the Smithsonian Institution. The first paper of this series was published in the present volume of the Journal, pp. 363–369.

[2] N. Amer. Fl. **17**: 179. 1909.

[3] Contr. U. S. Nat. Herb. **17**: 234. 1913.

Type in the herbarium of the University of Illinois, collected at San Salvador, Salvador, by Paul C. Standley (no. 19129).

Cuscatlania Standl., gen. nov.

Slender perennial herbs with branched stems; leaves opposite, those of a pair very unequal, the blades entire; flowers in terminal few-flowered leafy-bracted inflorescences, cymose-paniculate, solitary or in pedunculate clusters of 2 or 3, surrounded by an involucre of 4–8 distinct foliaceous bracts; perianth funnelform, corolla-like, purple-red, the tube elongate, scarcely constricted above the ovary, the limb shallowly 5-lobate; stamens 3, the filaments filiform, slightly exserted, inserted upon the perianth tube at its middle, the anthers didymous; ovary oblong, the style filiform, exserted, the stigma capitate; anthocarp oblong-obovoid, constricted at base and apex, almost equally 10-costate.

Type species, *Cuscatlania vulcanicola* Standl.

In general appearance the present plant closely resembles some of the species of *Allionia* and *Mirabilis*, to which it is no doubt related. In those genera, however, the flowers are surrounded by a calyx-like involucre of united bracts. The insertion of the stamens upon the perianth tube is unique in the family Allioniaceae, so far as I am aware.

Cuscatlania vulcanicola Standl., sp. nov.

An ascending or decumbent herb, the slender branches glabrous below, puberulent or villosulous above; petioles slender, mostly 1–1.5 cm. long, glabrous or sparsely puberulent; leaves of a pair very unequal, the smaller less than half the size of the larger ones; larger leaf blades ovate to oblong-ovate or lance-oblong, 5–12 cm. long, 3–4.5 cm. wide, acuminate or long-acuminate, very unequal at base, on one side rounded, on the other acute or acuminate, slightly fleshy, glabrous or nearly so, with numerous and conspicuous raphids on both surfaces; cymes dense, the bracts numerous, leaf-like, 1–2 cm. long, densely viscid-villosulous, short-petiolate, the branches of the inflorescence also densely viscid-villous; flowers sometimes solitary and often in clusters of 2 or 3, the subtending bracts free to the base, 4 to 8, foliaceous, lanceolate or oblanceolate to oblong-elliptic, 10–15 mm. long, acute or acuminate, narrowed at base into a short petiolule, long-ciliate and viscid-villous; perianth about 3 mm. long, the tube very slender, densely viscid-villous with very short hairs, the throat 3–4 mm. in diameter; fruit about 8 mm. long and 3 mm. in diameter, very sparsely and minutely hirtellous.

Type in the U. S. National Herbarium, no. 1,137,438, collected in a quebrada near the base of the Volcán de San Vicente, Departamento de San Vicente, Salvador, altitude about 500 meters, March, 1922, by Paul C. Standley (no. 21678).

The generic name is derived from Cuscatlán, the ancient name of the region which now forms the Republic of El Salvador.

Capparis stenophylla Standl., sp. nov.

Shrub, 1–1.5 m. high, glabrous throughout; leaves mostly clustered near the ends of the branches; petioles very variable in length, often nearly ob-

solete and frequently as much as 7 cm. long, slender; leaf blades narrowly lanceolate to lance-linear, mostly 17–26 cm. long and 1.5–6 cm. wide, acute to long-attenuate at apex, rounded or subcordate at base, lustrous above and with prominulous venation, paler beneath, the venation very prominent, rather thin; flowers subumbellate, on peduncles 2.5–5 cm. long, the pedicels slender, 6–20 mm. long; sepals imbricate in bud, rounded-ovate, obtuse, 2–3 mm. long; petals white, 12 mm. long or more; immature fruit long-stipitate, cylindric, somewhat torulose.

Type in the U. S. National Herbarium, no. 1,137,442, collected in a quebrada near San Vicente, Salvador, altitude about 500 meters, March, 1922, by Paul C. Standley (no. 21681). The following additional specimens have been examined.

SALVADOR: Sonsonate, alt. 220 meters, *Standley* 22330. Sierra de Apaneca, near Finca Colima, Departamento de Ahuachapán, *Standley* 20121.

NICARAGUA: Without definite locality, *Wright*.

Capparis stenophylla may be no more than a narrow-leaved form of *C. baducca* L., a common species of Central America, but the leaves are of so distinctive a form that it seems probable that the Salvadorean shrub merits specific rank.

Sedum salvadorense Standl., sp. nov.

Plants perennial, the stems suffrutescent, about 14 cm. high and 6 mm. thick, granular-papillose above; leaves rather few, alternate, narrowly spatulate-oblanceolate, 2–9 cm. long, 0.5–2 cm. wide, obtuse or rounded at apex, narrowed below into a broad petiole, flat, thin and flaccid, green, the young ones granular-papillose; inflorescence a dense few-flowered cyme about 2 cm. broad, the bracts small, linear or oblanceolate, papillose, the pedicels slender, 2–3 mm. long; sepals linear-oblong, 4–4.5 mm. long, narrowed to a blunt apex; petals white, oblong-ovate, equaling the sepals, cuspidate-acute.

Type in the U. S. National Herbarium, no. 1,136,003, collected on a rock in forest, Finca Colima, Sierra de Apaneca, Departamento de Ahuachapán, Salvador, January, 1922, by Paul C. Standley (no. 20143).

Only a single colony of the plants was found, and the plants were somewhat withered as the result of the long dry season. In spite of their unsatisfactory condition, the specimens seem to represent a species clearly distinct from any heretofore reported from Central America or from Mexico.

Prunus axitliana Standl., sp. nov.

Shrub or tree, 3–7.5 m. high, glabrous throughout, the crown broad and rounded, the young branchlets bright red; petioles slender, 7–11 mm. long, bright red; leaf blades ovate or elliptic-ovate, 5.5–11 cm. long, 2.5–5 cm. wide, obtusely acute or acuminate, rounded to subacute at base, very lustrous on the upper surface, the costa depressed, paler and dull beneath, the slender costa salient, two small round glands present on the lower surface of the blade about 3 mm. above the base; fruiting racemes solitary on young branchlets of the year, stout, about 4 cm. long, few-fruited, the pedicels stout, 6 mm. long; calyx deciduous; fruit subglobose, 10–12 mm. in diameter.

Type in the U. S. National Herbarium, no. 1,152,610, collected on hills near Santa Tecla, Salvador, March, 1923, by Dr. Salvador Calderón (no. 1519). The following sterile specimens obtained by the writer in 1922 also belong here:

SALVADOR: Santa Tecla, alt. about 900 m., *Standley* 23011. Volcán de San Vicente, alt. 1500 m., *Standley* 21515.

Prunus axitliana is related to *P. samydoides* Schlecht., a Mexican species, but is distinguished by its solitary racemes and large leaves. Dr. Calderón reports the vernacular name as *cangrejillo*. The specific name commemorates the King or Topilzín Axitl, founder of the Province of Cuscatlán and of the kingdom Hueytlato or Payaquí, now the Republic of El Salvador.

Acacia calderoni Standl., sp. nov.

A shrub, the branches brown, the young ones densely fulvous-pilose, unarmed; stipules linear-subulate, 5–7 mm. long; petioles 1.5–2 cm. long, without glands, the leaf rachis 5–7 cm. long, densely fulvous-pilose; pinnae 6–9 pairs, mostly 3.5–5.5 cm. long; leaflets about 23 pairs, oblong, 4–6 mm. long, 2 mm. wide, very obtuse, densely covered on both sides, especially beneath, with curved yellowish hairs, the venation obsolete on the upper surface, but both costa and lateral nerves prominent beneath; peduncles axillary or forming a terminal raceme, solitary or geminate, 1–1.5 cm. long, densely pilose; flowers racemose, the racemes very dense, 1.5–2 cm. long, about 1.5 cm. in diameter, the pedicels very short; calyx and corolla 2.5 mm. long, densely pilose with short yellowish hairs.

Type in the U. S. National Herbarium, no. 1,151,942, collected on the Cerro de la Olla, on the Guatemalan frontier near Chalchuapa, Salvador, in 1922 by Dr. Salvador Calderón (no. 977).

Closely related to *A. polypodioides* Standl., a species of southern Mexico and Nicaragua, but easily recognized by the elongate racemes, the flowers of *A. polypodioides* being capitate.

Pithecollobium microstachyum Standl., sp. nov.

Tree, 6–7.5 m. high, the young branchlets slender, puberulent or short-pilose; stipular spines stout, brownish, 1.5 cm. long or less; petioles sometimes 4 cm. long but often much shorter, glabrous, or puberulent, bearing at the apex a stout columnar sessile gland; pinnae one pair, the leaflets also one pair, nearly sessile, oblong to oblong-obovate, mostly 3.5–7 cm. long and 1.5–3 cm. wide, but on flowering branches often not over 1 cm. long, rounded or very obtuse at apex, oblique and obtuse or rounded at base, thick, slightly glabrous but ciliate when young, the venation prominently reticulate on both surfaces; flowers dirty white, in slender spikes 1–3 cm. long, these mostly in ample terminal panicles, the rachis pilosulous, the bracts lance-oblong, shorter than the calyx; calyx sessile, about 1 mm. long, acutely dentate, minutely appressed-pubescent; corolla 3 mm. long, minutely sericeous, the lobes oblong-lanceolate, acute; stamen tube not exserted; fruit several-seeded, short-stipitate, curved or coiled, minutely puberulent or glabrate, the valves thin, red or pink, constricted between the seeds; seeds black and shining, 7–8 mm. long and broad, compressed, surrounded at base by a fleshy white aril.

Type in the U. S. National Herbarium, no. 1,136,477, collected in dry

thicket near La Unión, Salvador, near sea level, February, 1922, by Paul C. Standley (no. 20646). The following additional specimens have been collected:

SALVADOR: Acajutla, *Calderón* 1663; *Standley* 21975.
HONDURAS: Amapala, *Standley* 20744.

It is probable that this is the tree reported from the Gulf of Fonseca by Hemsley as *P. oblongum* Benth. The Salvadorean plant is distinguished from that species by its elongate spikes and very small flowers. The vernacular name employed at La Unión is *mongollano*, a name applied also to *P. dulce* (Roxb.) Benth.

Apalatoa choussyana Standl., sp. nov.

Tree, the branchlets and leaves glabrous; bud scales densely brownish-tomentulose; leaflets 6 or 8, oblong or lance-oblong, 3–6.6 cm. long, 1.5–2 cm. wide, acute or short-acuminate, with blunt tip, unequal at base, cuneate on one side, rounded on the other, thick and firm, lustrous above, paler beneath, the costa subimpressed above, prominent beneath, the lateral nerves not conspicuous; petiolules 2 mm. long, the leaf rachis and petioles together 5–8 cm. long; rachis of the inflorescence and peduncle in fruit 5–9 cm. long, glabrous; fruiting pedicels 4–5 mm. long, stout; legume orbicular or rounded-oval, 5–7 cm. long, 4–5.5 cm. wide, thin, with slightly thickened margin, densely and minutely fulvous-tomentulose, conspicuously rugose.

Type in the U. S. National Herbarium, no. 1,152,621, collected on the Finca San Nicolás, Salvador, May, 1923, by Dr. Salvador Calderón (no. 1573).

At the request of Dr. Calderón this species is named in honor of Mr. Felix Choussy, for many years a resident of Salvador and formerly director of the Escuela de Agronomía, of the Salvadorean government, which was located at Izalco. The vernacular name of the tree is said to be *chichipate*.

Only one species of *Apalatoa* has been reported previously from Central America, **A. Acuminata** (Benth.) Standl.,[4] which was collected by one of the collectors who accompanied the British ship *Sulphur* in its voyage along the western coast of tropical America. The type of this species is said to have come from "Central America," and it is probable that it was collected either at Realejo, Nicaragua, or about the Gulf of Fonseca. The writer has seen no specimens of *A. acuminata*, but according to the description, it differs from *A. choussyana* in its large, abruptly acuminate leaflets, which are widest above the middle. **Apalatoa antillana** (Urban) Standl.[5] also is closely related to the Salvadorean tree, but differs in its larger, thinner, and comparatively narrow leaflets.

Cashalia Standl., gen. nov.

Large unarmed trees; leaves odd-pinnate, the leaflets herbaceous; stipules minute, caducous; flowers racemose, the racemes elongate, many-flowered, simple, the bracts and bractlets caducous; calyx tube broadly campanulate,

[4] *Crudia acuminata* Benth. Bot. Voy. Sulph. 89. 1844.
[5] *Crudia antillana* Urban, Symb. Antill. 6: 10. 1909.

the limb 5-lobate, the 3 lower lobes triangular-ovate, subequal, the 2 upper ones similar, united for half their length; petal one, rounded-obovate, narrowed below into a broad claw; stamens 10, free, subhypogynous, the filaments slender but broadened below, glabrous, subequal, the anthers oval, uniform, attached near the base, dehiscent by longitudinal slits; ovary short-stipitate, 2-ovulate, attenuate to a slender curved style, the stigma terminal, minute; fruit ovoid or cylindric, 1 or 2-seeded, turgid and subterete, coriaceous, bivalvate; seeds large, ovoid, exarillate, without endosperm, the cotyledons thick and fleshy, the radicle very short, inflexed.

Type species, *Cashalia cuscatlanica* Standl.,

Cashalia cuscatlanica Standl., sp. nov.

A very large deciduous tree, the young branchlets and petioles densely brown-pilose with stiff spreading hairs; leaves petiolate, the rachis 20–35 cm. long, subterete, brown-pilose; leaflets usually 11 or 13, alternate, the petiolules stout, 2.5–6 mm. long, densely pilose, the blades mostly oblong or lance-oblong, usually broadest below the middle but sometimes broadest toward the apex, acuminate or long-acuminate, broadly rounded or subcordate at base, mostly 9–23 cm. long and 2.5–9 cm. wide, the lower ones smaller, thin, bright green on the upper surface and glabrous, beneath paler, densely pilose with short spreading brownish hairs, the lateral nerves 13–19 pairs, nearly straight, extending quite to the margin, the secondary nerves in age prominent and closely reticulate; rachis of the racemes about 30 cm. long, stout, densely brown-tomentose, the pedicels stout, 2–3 mm. long; calyx about 8 mm. long, densely brown-tomentose, the lobes about equaling the tube, obtuse or subacute, tomentose within; standard about 18 mm. long, the blade 15 mm. broad, rounded at apex, tomentose on the outer surface, glabrous within; stamens about 15 mm. long, the anthers scarcely 1 mm. long; ovary densely brown-pilose, the style nearly glabrous; fruit 6–10 cm. long, subterete, acute at base and apex, covered with a very dense and fine, brown tomentum, the stipe very stout, about 6 mm. long; seeds terete-ovoid, 3–4 cm. long, 2 cm. in diameter, pointed at base, rounded at apex.

Type in the U. S. National Herbarium, no. 1,136,051, collected in mountain forest on the Finca Colima, Sierra de Apaneca, Departamento de Ahuachapán, Salvador, January, 1922, by Paul C. Standley (no. 20197). The following additional collections belong here:

SALVADOR: Comasagua, December, 1922, *Calderón* 1379. Hills near Santa Tecla, July, 1923, *Calderón* 1752.

The genus *Cashalia*, a member of the family Fabaceae, appears to be closely related to *Tounatea* (*Swartzia*), the specimens of the Salvadorean tree bearing some superficial resemblance to the curious Brazilian *Swartzia polycarpa* Ducke. In the genus *Tounatea*, so far as can be learned, the stamens are always numerous. Bentham and Hooker state that the ovules also are numerous, but this is improbable since the various species often have one-seeded fruits. The calyx of *Cashalia* is very different from that of *Tounatea*, and there is nothing to indicate that it is closed in anthesis, as it is in the latter genus.

Cashalia cuscatlanica is perhaps the most abundant and probably the largest tree in the primeval forest of the Finca Colima. At the time of the writer's visit to that region, the trees were in flower and nearly devoid of

leaves. The trees were so large that it was impossible to climb them in order to get specimens, but some of the racemes were found upon the ground and leaf specimens were secured from young plants. Dr. Calderón's specimens from Comasagua are sterile, but recently he was so fortunate as to find ample fruiting material on the hills near Santa Tecla, whose flora is similar to that of the Sierra de Apaneca. Dr. Calderón has forwarded a photograph of the tree from which the fruits came, eivdently a gigantic one, which he states was larger than a ceiba, sufficient indication of its size to those who are acquainted with Central American trees. The seeds were found upon the ground, where they were beginning to germinate, their cotyledons at that time being of a deep but brilliant green.

This tree is well known in Salvador, under the vernacular name of *cashal*. It is said to be an important lumber tree.

Amerimnon cuscatlanicum Standl., sp. nov.

Tree, the branchlets and leaves glabrous; stipules oblong-ovate, 10–12 mm. long, obtuse, soon deciduous; leaves somewhat blackened in drying, the petioles and rachis slender, 20–25 cm. long, the petiolules slender, 2.5–4 mm. long; leaflets 13–17, lance-oblong or the lowest ovate, 6–10 cm. long and 2–2.5 cm. wide, the lower ones smaller, slightly narrowed to the obtuse apex, rounded to subacute at base, thin, bright green above, the venation prominently reticulate, much paler beneath, the venation prominent and finely reticulate; racemes numerous, forming a dense panicle about 8 cm. long on old wood, the bracts similar to the stipules, ciliate, the branches densely brown-pilosulous, the bractlets minute, oblong, densely pilosulous; flowers white, about 16 mm. long; calyx 4–5 mm. long, densely brown-pilosulous, the lobes about equaling the tube, oblong-ovate, obtuse, the carinal lobe much longer and narrower than the others; petals glabrous, the standard short-clawed, the blade suborbicular, 12 mm. long, rounded at base, obscurely retuse at apex, the wings obovate, oblique, rounded at apex, nearly 10 mm. long.

Type in the U. S. National Herbarium, no. 1,152,618, collected at San Salvador, Salvador, in 1923, by Dr. Salvador Calderón (no. 1557). Sterile specimens which probably represent the same species were collected at Comasagua in December, 1922, by Dr. Calderón (no. 1555).

The Salvadorean tree is related to **Amerimnon lineatum** (Pittier) Standl.[6] and **A. retusum** (Hemsl.) Standl.,[7] of Costa Rica and Panama, but differs from both in its perfectly glabrous leaflets, which are also more numerous and narrower. The vernacular name is *funera*. The wood is highly valued for cabinet work and for general construction purposes.

Amerimnon lineatum, described from the Nicoya Peninsula of Costa Rica, also has been collected at San Salvador, where it bears the name of *funera*. Dr. Calderón states that the trees of *A. cuscatlanicum* are leafless during the dry season, but that in the middle of March the young leaves and flowers are produced, the flowers, however, lasting only two or three days. The stipules are conspicuous upon the very young branches, but quickly fall.

[6] *Dalbergia lineata* Pittier, Journ. Washington Acad. Sci. **12**: 63. 1922.
[7] *Dalbergia retusa* Hemsl. Diag. Pl. Mex. 8. 1878.

The specific name is derived from Cuscatlán, the aborginal name of the Valley of San Salvador and of its principal city.

Amerimnon melanocardium (Pittier) Standl.

Dalbergia melanocardium Pittier, Journ. Washington Acad. Sci. **12**: 57. 1922.

The type of this species was collected in the Department of Santa Rosa, Guatemala. It has been recollected recently at Santa Tecla, Salvador, by Dr. Salvador Calderón (no. 1517), who reports the vernacular name as *chapulaltapa*, a name applied in Salvador to several leguminous trees of various genera.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

WASHINGTON ACADEMY OF SCIENCES

176TH MEETING

The 176th meeting of the ACADEMY was held jointly with the Geological Society of Washington, the Biological Society of Washington, and the Botanical Society of Washington in the Auditorium of the Interior Building, the evening of Wednesday, March 14, 1923. The evening was devoted to a symposium upon *The fossil swamp deposit at the Walker Hotel site*, Connecticut Avenue and De Sales Street, Washington, D. C. The program was as follows:

C. K. WENTWORTH. *The geologic relations.* (Read with supplemental remarks by L. W. STEPHENSON.)

E. BROWN, Department of Agriculture. *Seeds and other plant remains.* (Presented by FREDERICK V. COVILLE.)

E. W. BERRY, Johns Hopkins University. *The plant remains and their significance.*

ALBERT MANN, Carnegie Institution. *The remarkable fresh water diatom flora from the swamp deposit, and its significance.*

LAURENCE LA FORGE. *The physiographic relations of the swamp deposit.*

These addresses will be published in full in the JOURNAL of the Washington Academy of Sciences.

177TH MEETING

The 177th meeting of the ACADEMY was held jointly with the Philosophical Society of Washington, the Washington Society of Engineers, and the American Society for Steel Treating, in the Auditorium of the Interior Building, the evening of Saturday, March 31, 1923. Dr. WALTER ROSENHAIN, F. R. S., of the National Physical Laboratory, England, delivered an address entitled, *The structure and constitution of alloys.*

Dr. ROSENHAIN discussed the general theory of the constitution of ferrous and non-ferrous alloys, the construction of constitutional diagrams which represent graphically the transformations that occur in a metal or an alloy on cooling or heating, their interpretation and relation to the physical properties of alloys. Lantern slides of typical constitutional diagrams were shown and discussed. The question of laboratory equipment for the study of the structure and physical properties of alloys was next considered, and many interesting photographs and diagrams were shown of apparatus developed

by Dr. ROSENHAIN and his collegaues at the National Physical Laboratories. These included special microscopes, heating and quenching furnaces, special furnaces for the determination of thermal transformations and high temperature thermostats. The latter are used for the heating of alloy specimens for a period of several weeks or months at a constant temperature which has been proved necessary to obtain equilibrium conditions. The development of this thermostat has made possible the determination of the constitutional relation of certain alloys in which the phase changes take place very slowly and about which there has consequently been considerable doubt.

Dr. ROSENHAIN also discussed briefly the organization of the department of metallurgy at the National Physical Laboratories and some of their problems, particularly their work on the ternary diagrams of the light aluminum alloys.

178TH MEETING

The 178th meeting of the ACADEMY was held jointly with the Philosophical Society of Washington and the Chemical Society of Washington in the Auditorium of the Interior Building, the evening of Tuesday, April 17, 1923. Dr. JAMES C. IRVINE, Principal and Vice-Chancellor, University of St. Andrews, and Dr. F. G. DONNAN, Professor of Chemistry, University College, London, addressed the Societies concerning their own recent researches in chemistry.

Principal IRVINE spoke on researches on *The constitutional formula of starch.* The first step was to determine the constitution of maltose, and this proved amenable to a method already developed by the speaker in which glucosides and complex carbohydrates are methylated before hydrolysis. Determination of the constitution of the scissive products thus obtained shows how the constituents of the complex molecule have been combined. By this method the maltose molecule was shown to be formed from two glucose residues by junction at the ends of the carbon chain. A similar process carried out on starch showed that two-thirds of the products corresponded with those obtained from maltose, but the remaining one-third showed that a third molecule of glucose goes to make up the unit molecule of starch and that it is attached in the manner characteristic of cellulose. The simplest possible unit for starch is therefore one containing the nuclei of three molecules of glucose, two attached as in maltose and the third as mentioned above. An objection to this is that some experimenters have claimed a larger yield of maltose than the 72 per cent which would result from starch of this structure. These yields, however, refer to material which does not behave as a chemical individual towards bacteriological tests, and the most careful experimenters have declared that the maximum yield of the pure substance is about 70 per cent.

Professor DONNAN discussed *Membrane equilibrium.* He dealt with a number of cases of solutions separated by membranes which are impermeable to certain of the ions. The exact equations for the relative concentrations can be obtained by Gibbs' method of equating the μ-function for the ions which can pass the division. Approximate results may be obtained by using the usual dilute solution formula for the μ-function. These approximations agree fairly closely with the results of a large number of experiments on solutions of various salts separated by ferrocyanide and other membranes. The predicted differences in e.m.f. across the membrane also agree fairly well with the facts.

179TH MEETING

The 179th meeting of the ACADEMY was held jointly with the Geological Society of Washington and the Philosophical Society of Washington in the Auditorium of the Interior Building, the evening of Wednesday, April 18, 1923. The program consisted of three addresses dealing with *The Taylor-Wegener hypothesis.*

The first paper, by FRANK B. TAYLOR, was entitled, *The lateral migration of land masses.*

One of the most remarkable things on the Earth is the great belt of Tertiary fold-mountains which forms a nearly complete girdle around the globe. It is believed that the distribution of this belt and certain other well defined characteristics associated with it furnish the key to the nature of the cause which made it. These mountains form a folded and faulted margin along the entire southern front of the continent of Eurasia; then passing over into North America through the arc of the Aleutian Islands, which in reality belongs to the Asiatic structure, the belt turns southward and forms the Cordilleran ranges through the entire length of the two Americas. From the East Indies a branch extends eastward and southward around the north and east sides of Australia to New Zealand, but shows only as chains of volcanic islands. The ranges of the entire belt are all of substantially one age; they were all either greatly augmented or made outright in the Tertiary age.

The salient facts are these, and they have a profound bearing on the nature of the cause: (1) The Tertiary ranges which lie along the southern margin of Eurasia show many times the strength of those parts which are related to the two Americas and to Australia, and this applies to all of the phenomena associated with them—to the arcuate expression of the ranges and the larger earth-lobes, to the rifts in high latitudes, and to the narrow foredeeps. (2) Although the development of subsidiary arcs in the two Americas is much weaker than in Asia, it is much stronger than that associated with Australia, where no subsidiary arc-forms are recognizable. (3) The cause, whatever its nature, is clearly and strongly related to latitude. The continental crust-sheets of Eurasia and North America migrated in southerly directions, while at the same time those of South America and Australia moved in northerly directions. All of the masses that moved migrated from high latitudes toward low latitudes, as though impelled by a force which tended to increase slightly the oblateness of the Earth's figure. (4) The Tertiary mountain belt mapped on Mercator's projection does not give a true idea of the relation of the crustal sheet of Eurasia and its marginal mountain belt. On a north-polar projection, or better on the land-hemisphere, one sees that from the Canary Islands to the mountain angle in Alaska is about 230° of longitude, or considerably more than half-way around the globe. The striking uniformity of strength through this whole distance is strong proof that it was the continental crust-sheet which moved southward in forming the mountains, rather than the sinking and landward thrusting of oceanic segments, an idea which would require India and Africa to be counted with the sinking masses, whereas Suess says that India and Africa remained unmoved during the Tertiary mountain-making. Many separate segments would necessarily be involved, but to produce the observed uniform result they must all act with about equal strength, and with markedly

greater strength than those segments which affected the two Americas and Australia.[1]

In the opinion of the writer the movements of the continental land masses in the Tertiary mountain-making are not in accord with any form of contraction hypothesis, neither with that derived from Laplace, nor Chamberlin, nor Wegener, but are in perfect accord with the action of a tidal force. The present tidal force exerted by the Moon upon the Earth is calculated to be equal to about 1/1,000,000th of gravity—too small, apparently, to be regarded as competent. The problem, then, is to find a competent tidal force.

For many years the writer has entertained a theory of direct capture for the origin of satellites, including, of course, the Moon. The event of the Moon's capture toward the close of the Cretaceous period, and its retention as a permanent satellite of the Earth, furnishes the circumstance and a competent agency for the production of the necessary tidal force. The following considerations are believed to afford adequate support for this claim.

"The tide-producing force of a body varies inversely as the cube of its distance and directly as its mass." (Young's Manual, 1912, p. 303). The Moon's present mean distance is in round numbers 240,000 miles. At half this distance the tide-producing force would be 8 times as strong. At 1/10th or 24,000 miles it would be 1000 times as strong. At 1/20th or 12,000 miles it would be 8000 times as stong. The present tidal force is equal to about 1/1,000,000th of gravity. At 24,000 miles it would be 1/1,000th of gravity, and at 12,000 miles 1/125th of gravity.

The eccentricity of the Moon's present orbit is 0.0549, or nearly twice that of any other large satellite. The first fourteen of the short-period comets in Young's table (p. 586) have eccentricities ranging from 0.40 to 0.84. If the Moon was acquired by direct capture, as here postulated, its eccentricity must have been much greater at first than it is now. In the absence of direct knowledge, it seems reasonable to assume that the Moon's eccentricity at the time of capture was of about the same order of magnitude as those of the short-period comets or something between, say, 0.50 and 0.90. Thus, when the Moon was first captured, the tidal force was, in all probability, something between 500 and 3000 times as strong as it is now. With the Moon's perigee 24,000 miles from the Earth, the tidal force would be 1000 times greater than it is now, and this is certainly a conservative assumption for the Moon's eccentricity at that time, and for its distance at perigee. Since capture, the reduction of eccentricity has, of course, been extremely slow, capture having taken place at least two or three millions and perhaps four or five millions of years ago.

At the present time earthquakes show well marked maxima and minima corresponding to the Moon's nearest and farthest distances from the Earth respectively. This effect is intimately responsive to the varying power of the tidal force, and with increasing degrees of eccentricity and decreasing distance of perigee it would be rapidly increased under the law stated above. The maximum tidal force would, of course, act for only a few days in each month, but it would be very powerful and fully competent, in the writer's opinion, to produce the observed results. It would tend to increase by a small amount the oblateness of the Earth, and would by so much increase,

[1] In a paper entitled *Bearing of the Tertiary Mountain Belt on the origin of the Earth's plan* (Bull. G. S. A., **21**: 179-226. 1910) the writer discusses these and other points more fully.

in effect, the altitude of all lands in high latitudes. It would also exert a powerful force tending to cause high-standing crustal masses in high and middle latitudes to creep away toward low latitudes, leaving rifts near the poles, and causing folding, faulting, and uplifting, with narrow outside foredeeps in a marginal belt toward the equator, precisely as is so well exemplified in the distribution and characteristics of the great Tertiary mountain belt. To accomplish this, the Earth, in the writer's opinion, must be supposed to have a solid, rigid central body, viscous to prolonged stress in a film next beneath the zone of fracture.

The crustal movements and mountain-making of the earlier geologic periods are not related in any way to the Moon's tidal force, for the Moon had not then been captured. They are, in all probability, related to the solar tidal force which was much more powerful in its action on the Earth, when the Earth was nearer to the Sun. (*Author's abstract.*)

A critical review of the Taylor-Wegener hypothesis was next presented by Prof. REGINALD A. DALY, Harvard University.

According to Pepper's *Playbook of metals*, published in 1861, the suggestion that continents have migrated through long distances had already been clearly expressed by M. A. Snider. The idea was adopted by O. Fisher in his *Physics of the Earth's crust* (1889), and has been greatly elaborated by F. B. Taylor (1910) and A. Wegener (1912–1922). The general grounds for the hypothesis include: many topographic, structural, and biological (paleontological) correspondences among the continents; the difficulties of land-bridge theory; the difficulties facing other theories of crustal deformation; and the asymmetry, arcuate plans, of mountain chains. The following abstract relates especially to Wegener's statement.

Wegener assumes (1) that essentially all of the Paleozoic land formed one continent, which had been derived from a universal salic shell of the primitive earth; (2) the flotation of this unique continent in a practically fluid, basaltic shell (the *Sima*), which also floors the whole ocean; (3) the existence of a force sufficient to cause a drift of continental blocks toward the equator (the *Polflucht*); (4) the existence of a force sufficient to move each continent to the westward (*Westwanderung*); and (5) the spasmodic displacement of the earth's axis of rotation with reference to the crust, and that through many tens of degrees.

He concludes that the *Polflucht* force caused the east-west mountain chains of the Paleozoic, Mesozoic, and Cenozoic eras. During the Mesozoic the great continent was broken into large fragments which then, and at intervals until the present day, drifted, and either separated, with the formation of the Arctic, Atlantic, and Indian oceans, or collided, with the development of mountain ranges in the loci of collision. He explains all islands as fundamentally salic, representing the smaller fragments; the arcuate mountain ranges of eastern Asia are fragments left behind during the westward migration of Eurasia. With these exceptions all mountain chains are attributed to the downstream pressures exerted by moving continental blocks. Taylor had adopted the same conclusion but made no exception of the east-Asiatic arcs, whose asymmetrical but systematic plan prompted his statement of 1910.

Wegener's assumption of practically no strength in the sub-oceanic crust, the salic, continental part having notable strength, is basal to his whole reasoning and yet appears to be quite indefensible. Believing the *Sima*, cold or hot, to be essentially fluid, he could permit himself to think that

rotational and tidal forces are adequate to cause the *Polflucht* and *Westwanderung* of floating continents. Lambert, Epstein, and Schweydar have proved the insignificance of these forces.

Wegener lays down as a principle that, during the westward migration, the larger continental blocks should outstrip the smaller. Yet he considers the less massive Americas to have moved faster than Eurasia-Africa, which was also left behind by the long but narrow fragment represented in the mid-Atlantic swell. This is but one of several inconsistencies in his reasoning.

His speculation regarding extensive wanderings of the poles encounters both geophysical and geological difficulties. With the earth's axis in the positions given in the third edition of his book, one has trouble in accounting for many facts, including: the Mesozoic coals of South Africa and the Cretaceous coals of British Columbia; the persistence of the Tethys and correlated lands; and the postulated movement of India (which actually had to climb the *Polflucht* slope). Wegener assumes peninsular India to have been endowed with energy out of all proportion to its mass, but offers no reason for the peculiarity of this particular fragment of the Paleozoic continent.

Wegener's presentation of the case has provoked much discussion and many objections, in addition to those listed. So obvious are his logical inconsequences and his failure properly to weigh ascertained facts that there is danger of a too speedy rejection of the main idea involved. The question remains whether a better statement of the hypothesis can be made in terms of: (1) considerable strength of the suboceanic crust as well as of the continental part of the crust; (2) a density of the suboceanic crust greater than the density of the basaltic shell (substratum) immediately beneath it, involving one cause of crustal instability; (3) possibly a similar, though smaller, contrast of densities in the case of the continental part of the crust and its basaltic substratum; (4) the elastico-viscosity of the basaltic substratum, rigidity and time of relaxation increasing to a depth of about one-half of the earth's radius; (5) deleveling of the continental part of the crust through a combination of oceanic pressure, the earth's contraction, secular denudation, differential radioactivity, secular dimunition of the earth's rotational velocity (the axis fixed), and the temporary deformation of the geoid because of overthrusting. Such deleveling gives a second condition for instability. When the amplitudes of the crustal inequalities became large enough, a break-up of the Paleozoic continent and the sliding of the fragments were compelled. The sliding is expected to have been directed toward the central Pacific, on all sides of that basin, and also directed in the sense of the meridian. (See two articles in the American Journal of Science, May, 1923.)

Whether or not this sliding hypothesis can be shown to be more valid than Wegener's drift hypothesis, geologists have good reason to retain the root idea embodied in the writings of Fisher, Taylor, and Wegener. (*Author's abstract.*)

The concluding address, by W. D. LAMBERT, of the United States Coast and Geodetic Survey, was entitled, *The mechanics of the Taylor-Wegener hypothesis of continental migration.*

The amount of published matter dealing with Wegener's development of the hypothesis of continental migration so greatly exceeds that dealing with Taylor's presentation, in spite of the latter's priority of publication, that this discussion necessarily deals with Wegener's form of the theory rather than with Taylor's.

The hypothesis of large displacements of the earth's axis of rotation in the body of the earth (or of the poles on the surface) forms part of Wegener's scheme, although it is not a necessary corollary of the assumption of continental migration. In general, large displacements of the pole, apart from oscillations of short period, imply extensive rearrangements of mass within or upon the earth, rearrangements too large for geologists to accept. On Wegener's scheme of continental blocks of "sial" floating in "sima" even the shifting of a large continental block over many degrees of great circle would involve such a small *effective* rearrangement of mass that the resultant displacement of the pole would be unimportant. Wegener cites two articles as tending to show that large displacements of the pole might take place without correspondingly large rearrangements of mass; one citation is based on a misapplication of the words quoted; the other article cited involves fundamental fallacies in mechanics.

If the earth were a rigid spheroid, an increase in its speed of rotation or in the tide-producing action of a satellite would tend to move a particle on its surface toward the equator. This idea has been invoked as a possible explanation of the equatorward drift of the continents. But the continents are not particles but masses of matter forming part of a continuous crust and therefore impeded in their motion by their surroundings; furthermore, the earth is not rigid but is presumably plastic under the action of long-continued forces. Therefore, the result of such an increase in the speed of rotation or in tidal action would be merely an increase in the flattening, to which the earth would adjust itself by plastic flow or by ruptures here and there, the continents remaining in the same general relative position with respect to their surroundings.

There is, however, a small residual equatorward force that acts on an object floating on the earth's surface. It is due to the change in direction of gravity with elevation and is approximately proportional to the distance between the center of gravity and the center of buoyancy of the floating body. This force is invoked by Wegener as an explanation of the equatorward movement of a continental block of "sial" floating in "sima." The force is so small (about 1/1,000,000 of gravity) that it seems inadequate to overcome the resistance of the "sima." In rebuttal to this objection it is urged that a very small force acting through geologic ages might produce considerable effects, since, in the yielding of a viscous liquid, time is the all-important element rather the magnitude of the force. This argument assumes that so-called solids like the "sima" are really extremely viscous liquids. There is, however, a real distinction between soft solids and viscous liquids, as was pointed out long ago by Clerk Maxwell, and as has been more recently verified by Bingham and Durham. It seems far more probable that the "sima" is a solid with a yield-point well above the stresses due to this extremely minute equatorward force than that it is a viscous liquid; if the "sima" is a true solid, the force in question would be ineffective in producing equatorward displacements of the continents.

The fact that the higher portions of the earth's crust are lighter than the deeper-lying portions and the hypothesis of isostasy based on this fact both suggest the conception of floating continental blocks, of which Wegener has made such free use. But this whole hypothesis of a floating crust is rather a convenient simile than an adequate statement of all the facts, and must not be pressed too far. On the hypothesis of isostasy the stresses in the crust are not hydrostatic (that is, such as occur in flotation) until the depth of com-

pensation is reached. The assumption of an absolutely rigid continental block floating in a liquid is therefore an unsatisfactory basis for calculating the stresses involved.

Taylor's conception of the continental migration makes it mainly toward the equator. Wegener conceives of it as mainly westward and suggests that this westward movement may be due to the deflecting force of the earth's rotation which would result from an equatorward movement. On the most favorable assumptions, however, the equatorward movement is so slow that this explanation is entirely inadequate.

The hypothesis of continental migration is a serious attempt to coordinate and explain facts that need explanation, but the suggested mechanical explanations of the migration are unconvincing. Till some more adequate explanation is offered, mathematicians and physicists are likely to doubt the validity of the hypothesis. (*Author's abstract*).

180TH MEETING

The 180th meeting of the ACADEMY was held in the Assembly Hall of the Cosmos Club, the evening of Thursday, October 18, 1923. Dr. ALEŠ HRDLIČKA, Curator, Division of Physical Anthropology, U. S. National Museum delivered an address on *Ancient man in Europe*.

The speaker, who had just returned from his third trip over the field of ancient man in Europe, gave a general account of his impressions, of the principal discoveries, and of the present status of research and opinion relating to Early Man.

The strongest impressions brought back are those of the vastness of the European territories and deposits yielding cultural and even skeletal remains of geologically ancient man; of the amount of work, particulrly that of an archeological nature, which has already been done in this field; of the far greater amount of work still to be done; and of the peculiar neglect of the field by American scientists, with the great opportunities for American participation now and in the future.

As the material evidence of man of different ages together with that of the contemporary fauna and the geological deposits accumulates, former conceptions in all these lines are changing. There is, especially, a growing uncertainty as to the subdivisions and duration of the Glacial Age. The problems of continuous or interrupted human evolution and progress, of the number of human varieties and races in the past, of the fate of some of them, and of the derivation of others that seem to have come from elsewhere, are all slowly being worked out; but in some if not all these respects anthropology is still far from a definite solution. There are many opinions, some of them held very tenaciously, but they are more or less premature. Much additional light is needed, light to be secured through systematic and thoroughly scientific work, such as is now being carried on at a few sites, especially in southern France.

What is demonstrated is that man has existed in Europe throughout or nearly throughout the Quaternary, and that he has in a large measure, if not entirely, developed there both culturally and physically.

In conclusion, Dr. HRDLIČKA, who among other results of his last journey was honored by being the first American scientist privileged to examine the original remains of the *Pithecanthropus*, again stressed the opportunities for American participation in active research in this great European and Old

World field; such participation would be welcomed and would exert a wholesome, stimulating influence in many directions.

The lecture was illustrated by charts and by photographs of a series of the most important localities where ancient skeletal remains of man were discovered.

WILLIAM R. MAXON, *Recording Secretary.*

THE BOTANICAL SOCIETY

165TH MEETING

The 165th meeting was held at the Cosmos Club, February 6, 1923, at 8 p.m. with Dr. H. L. SHANTZ in the chair, and 31 persons present.

Program: Dr. PERLEY SPAULDING: *Notes on some tree diseases in Europe.* (Illustrated.) *Melampsorella elatina* causes cankers on the trunks of *Abies pectinata* which greatly reduce the timber value. *Fomes annosus* causes root rot especially of *Abies pectinata*, in some places preventing the use of this species. *Cronartium ribicola* is generally distributed in Europe wherever *Pinus strobus* occurs. It is exterminating this species as well as *P. monticola* and *P. flexilis*, both of which are more susceptible than is *P. strobus*. *Pinus excelsa* is quite resistant and may well be substituted for *P. strobus*, not only in Europe but in North America. Trees of *P. strobus* from 4 to 118 years of age were killed by this fungus, age giving no degree of immunity. *Dasyscypha willkommii* attacks the larches in Great Britain, but a new hybrid larch is not only immune to this disease but is the fastest growing larch known there. *Robinia pseudacacia*, wrecked in America by *Fomes robiniae* and a wood borer, is a real tree in Europe because these two enemies have been left behind in America.

N. REX HUNT: *Steam and chemical soil disinfection.* A cheap, effective, practicable method of soil disinfection is needed to exterminate the potato wart disease before it spreads to important potato growing regions. Potato wart extermination methods were studied at Freeland, Pa., and Washington, D. C., 1920–22 by F. G. O'Donnell, Rush P. Marshall, and the speaker. The inverted steam-pan method was found fairly effective but expensive and impracticable for large scale use. A pressure regulator was found to insure more uniform treatment of soil. Soil temperature changes brought about by steaming were determined. Fourteen chemical treatments, ranging upward from $250.00 per acre in cost, were found effective against wart, mercuric chloride, borax, chloride of lime, copper sulphate, sodium carbonate, sodium fluoride, and sulphur were used dry. Kerosene and crude oil were used undiluted. Effective solutions were mercuric chloride, Bordeaux, cleaning solution, lime sulphur, sodium chromate, and Fairmount weed-killer. Some chemicals were applied to the surface and some were worked into the soil. The variable growth of potato plants in these treated plots is recorded. The effect of the treatments on the hydrogen-ion readings of the soil was recorded. A study of the effect of treatments on the soil flora was begun.

The influence of soil moisture and soil type on the penetration of some chemicals was determined and found to be very important. The addition of sodium chloride increased the penetration of mercuric chloride remarkably. Better penetration and more uniform distribution of this solution is secured by applying all chemicals in part of the water, and then applying the remainder of the water. Kerosene penetrates several times as well in damp as in dry soil. The various groups of data secured have a very practical bearing

on the problem of field treatments. A bibliography of 3,000 titles has been assembled. A better knowledge of the fundamental principles governing soil treatments, is greatly needed to aid in the solution of an ever increasing number of soil treatment problems.

166TH MEETING

The 166th meeting was held Tuesday, March 6, 1923, in the Crystal Dining Room of the New Ebbitt Hotel with 146 persons present.

Following dinner, Dr. W. E. SAFFORD, the retiring President, gave an address on *Economic botany as a means of determining the origin and dissemination of primitive tribes.*

Dr. A. F. WOODS, President of the University of Maryland and first President of the Botanical Society of Washington, was present as guest of honor.

After the address there was dancing.

ROY G. PIERCE, *Recording Secretary.*

SCIENTIFIC NOTES AND NEWS

F. E. MATTHES, of the U. S. Geological Survey, gave a lecture on November 3 before the Brooklyn Institute of Arts and Sciences on *The cliffs and waterfalls of the Yosemite Valley.*

T. WAYLAND VAUGHAN and A. H. BROOKS, who represented the Geological Survey at the Pan-Pacific Scientific Congress in Australia, have returned to Washington.

PAUL C. STANDLEY, of the National Museum, left recently for Panama, where he is to continue the investigation of the flora of the Canal Zone, a work commenced several years ago.